

The Genus *Kaestneriella* (Psocoptera: Peripsocidae)¹

EDWARD L. MOCKFORD AND WONG SIU KAI²

ILLINOIS STATE UNIVERSITY, NORMAL, ILLINOIS 61761

RECEIVED FOR PUBLICATION MAY 5, 1969

Abstract: Nine species and a possible tenth are now known in the genus *Kaestneriella*. Eight of these are here described as new and are named as follows: *K. guatemalensis*, *K. maculosa*, *K. mexicana*, *K. minor*, *K. obscura*, *K. occidentalis*, *K. pacifica*, *K. setosa*. An augmented diagnosis of the genus is presented. Figures of genitalic and forewing characters for all of the new species are included. A key to the known species is presented. The taxonomic treatment is based on examination of 185 adult specimens. The location of the major types of each new species is mentioned in its description. A brief discussion of phylogenetic relationships within this genus is included and is summarized with a dendrogram. The genus *Kaestneriella* is now known to occur from Costa Rica north to southern Arizona.

The genus *Kaestneriella* was established by Roesler (1943) on the basis of a single male specimen with *Peripsocus*-like venation (i.e., simple vein Cu_1 , three-branched median, pterostigma constricted basally), forewing veins well ciliated and forewing margin ciliated except at its tip. The figure of the phallosome showed it to be essentially as in *Peripsocus* but wide basally. The radula appeared to be composed of two sclerites, bilaterally symmetrical.

The present study is based on examination of 185 adult specimens of *Kaestneriella*, including eight species new to science, herein described. This investigation has allowed some clarification and modification of the original diagnosis of the genus, as follows:

1. In addition to forms with well-ciliated forewings, the group includes some species in which ciliation is very poorly developed, so that the individual setae cannot be noticed at magnifications less than 70 \times .
2. The phallosome is somewhat constricted basally in some species but never as much as is commonly found in *Peripsocus*.
3. As in *Peripsocus*, the pore-bearing (presumably external) parameres are median in position.
4. The clunial comb is broad, straight or slightly curved, and set on a quadrate posterior extension of the clunial margin.
5. The forewing is usually gray or grayish-brown in color over most of its

¹ This work was supported from September, 1961 to the present by National Science Foundation grants numbers 19263, GB-2713, GB-5163, and GB-7729. Support was received in 1961, 1965, and 1968 from Illinois State University grants numbers 61-15, 65-24, and 68-28.

² Present address of the junior author is Department of Agriculture, P.O. Box 241, Levin, New Zealand.

TABLE 1. Measurements (in mm), Ratios and Ctenidial Counts for species of *Kaestneriella*. IO/D, least head width between eyes divided by greatest antero-posterior diameter of an eye in dorsal view of head; PO, transverse eye diameter divided by greatest antero-posterior eye diameter in dorsal view of head; refer to text (page 225) for further information.

	Forewing length	Length of hind tibia	Length of hind tarsal segment 1	Length of hind tarsal segment 2	Number of ctenidia, hind tarsal segment 1	IO/D	PO
<i>Kaestneriella guatemalensis</i> , n. sp. ♂							
Sample size	8	8	8	8	8	8	8
Minimum	3.93	1.20	0.34	0.15	14	1.24	0.79
Maximum	4.35	1.35	0.37	0.17	19	1.77	0.90
Mean	4.17	1.26	0.35	0.16	16.4	1.54	0.84
S.D.	0.161	0.052	0.011	0.010	1.60	0.196	0.034
<i>Kaestneriella guatemalensis</i> , n. sp. ♀							
Sample size	14	14	14	14	14	14	14
Minimum	1.57	0.91	0.27	0.15	0	2.79	0.62
Maximum	2.31	1.10	0.30	0.17	1	3.20	0.70
Mean	1.81	1.02	0.28	0.16	0.1	2.98	0.65
S.D.	0.189	0.052	0.009	0.008	0.27	0.126	0.023
<i>Kaestneriella maculosa</i> , n. sp. ♂							
Three Specimens	2.28	0.84	0.25	0.12	16	1.67	0.57
	2.23	0.83	0.25	0.11	16	1.83	0.60
	3.12	1.01	0.28	0.13	15	1.82	0.79
<i>Kaestneriella maculosa</i> , n. sp. ♀							
One Specimen	1.90	0.84	0.23	0.11	12	2.64	0.57
<i>Kaestneriella mexicana</i> , n. sp. ♂							
Sample size	16	16	16	16	16	16	16
Minimum	2.77	1.09	0.30	0.12	11	0.74	0.54
Maximum	3.46	1.28	0.36	0.14	21	2.07	1.03
Mean	3.03	1.17	0.33	0.13	16.3	1.25	0.70
S.D.	0.181	0.054	0.016	0.004	3.03	0.389	0.142
<i>Kaestneriella mexicana</i> , n. sp. ♀							
Sample size	16	16	16	16	16	16	16
Minimum	2.24	0.91	0.24	0.08	3	2.09	0.47
Maximum	2.94	1.19	0.31	0.14	16	2.88	0.69
Mean	2.50	1.02	0.27	0.12	9.2	2.52	0.58
S.D.	0.179	0.089	0.024	0.016	5.29	0.173	0.050
<i>Kaestneriella minor</i> , n. sp. ♂							
Sample size	4	4	4	4	4	4	4
Minimum	1.74	0.71	0.19	0.09	11	1.08	0.68
Maximum	2.30	0.78	0.28	0.11	16	1.48	0.81
Mean	2.04	0.75	0.23	0.10	14.3	1.27	0.75
S.D.	0.255	0.028	0.041	0.011	2.22	0.184	0.055

TABLE 1 (Continued)

	Forewing length	Length of hind tibia	Length of hind tarsal segment 1	Length of hind tarsal segment 2	Number of ctenidia, hind tarsal segment 1	IO/D	PO
<i>Kaestneriella minor</i> , n. sp. ♀							
Sample size	9	9	9	9	9	9	9
Minimum	1.62	0.67	0.17	0.08	2	2.33	0.47
Maximum	1.83	0.77	0.20	0.11	12	2.84	0.65
Mean	1.75	0.71	0.19	0.10	5.7	2.61	0.55
S.D.	0.064	0.035	0.011	0.010	4.03	0.154	0.066
<i>Kaestneriella obscura</i> , n. sp. ♂							
Sample size	16	16	16	16	16	16	16
Minimum	2.78	0.95	0.28	0.10	12	0.80	0.56
Maximum	3.27	1.15	0.32	0.14	18	1.04	0.91
Mean	3.03	1.05	0.30	0.13	15.6	0.91	0.69
S.D.	0.160	0.050	0.015	0.009	2.19	0.062	0.093
<i>Kaestneriella obscura</i> , n. sp. ♀							
Sample size	10	10	10	10	10	10	10
Minimum	1.98	0.82	0.21	0.12	5	1.90	0.45
Maximum	2.42	1.01	0.27	0.15	21	2.67	0.58
Mean	2.23	0.93	0.24	0.13	7.8	2.45	0.51
S.D.	0.117	0.058	0.016	0.010	6.91	0.237	0.043
<i>Kaestneriella occidentalis</i> , n. sp. ♂							
Sample size	5	5	5	5	5	4	4
Minimum	2.71	0.86	0.25	0.12	15	0.48	0.59
Maximum	3.13	1.06	0.32	0.14	20	0.63	0.72
Mean	2.85	0.98	0.30	0.13	17.4	0.56	0.63
S.D.	0.164	0.073	0.032	0.009	2.07	0.078	0.060
<i>Kaestneriella occidentalis</i> , n. sp. ♀							
Sample size	19	19	19	19	19	19	19
Minimum	2.17	0.81	0.24	0.11	4	1.94	0.48
Maximum	2.44	1.05	0.30	0.14	16	2.40	0.75
Mean	2.29	0.90	0.27	0.13	10.3	2.17	0.66
S.D.	0.074	0.052	0.014	0.006	3.04	0.11	0.070
<i>Kaestneriella pacifica</i> , n. sp. ♂							
Sample size	4	4	4	4	4	3	3
Minimum	1.95	0.69	0.19	0.10	8	1.39	0.63
Maximum	2.11	0.83	0.23	0.10	14	1.48	0.69
Mean	2.02	0.77	0.22	0.10	11.5	1.44	0.65
S.D.	0.068	0.061	0.022	0.003	2.65	0.045	0.034
<i>Kaestneriella pacifica</i> , n. sp. ♀							
Sample size	4	4	4	4	4	4	4
Minimum	1.93	0.73	0.19	0.10	8	2.47	0.45
Maximum	2.90	0.79	0.22	0.12	13	2.78	0.60
Mean	1.86	0.76	0.20	0.11	10.5	2.59	0.51
S.D.	0.054	0.026	0.013	0.009	2.38	0.131	0.064

TABLE 1 (Continued)

	Forewing length	Length of hind tibia	Length of hind tarsal segment 1	Length of hind tarsal segment 2	Number of ctenidia, hind tarsal segment 1	I.O.D.	P.O.
<i>Kaestneriella setosa</i> , n. sp. ♂ (?)							
Single specimen	2.00	0.83	0.25	0.11	18	0.70	0.66
<i>Kaestneriella setosa</i> , n. sp. ♀							
Sample size	17	17	17	17	17	17	17
Minimum	1.57	0.63	0.17	0.09	4	2.13	0.49
Maximum	2.28	0.90	0.26	0.14	15	2.70	0.70
Mean	1.96	0.80	0.23	0.12	11.7	2.43	0.61
S.D.	0.151	0.062	0.025	0.011	3.00	0.192	0.074

surface, but there is generally a pattern of colorless regions, one such region above, one below, and one immediately distal to the R-M junction. This color pattern is best developed in females.

6. The female external genitalia are of the *Peripsocus* type, but the third ovipositor valvulae tend to be larger relative to the other valvulae than is generally seen in *Peripsocus*.

7. The cell R_5 of the forewing tends to be relatively wider than in *Peripsocus*. This may be shown quantitatively by the following technique (Fig. 54): on a tracing of the wing a line is drawn passing through the anterior margin of the wing base and bisecting a line drawn between the marginal ends of veins R_{4-5} and M_1 : three perpendiculars are drawn through this line, one passing through the point where R_5 and M branch apart, one passing through the point where M_3 branches from the main M stem, and one passing through the two points furthest apart on the veins delineating cell R_5 . The length between the first two perpendiculars (a) is divided by the greatest width of cell R_5 measured along the third perpendicular (b). The resulting index, herein called the R_5 index is recorded for a representative individual of each sex of each species included in this paper. The range of R_5 indices for males of *Kaestneriella* is 1.11 to 1.38. For males of five species of *Peripsocus* it is 1.38 to 1.70. The R_5 index has a much greater range in *Kaestneriella* females (1.15-1.63), and was not determined for *Peripsocus* females, as a wide overlap was anticipated.

In all species observed there is at least some sexual dimorphism in forewing length, the males having relatively longer ones than the females. This situation reaches an extreme in *K. guatemalensis*, n.sp., in which females are bra-

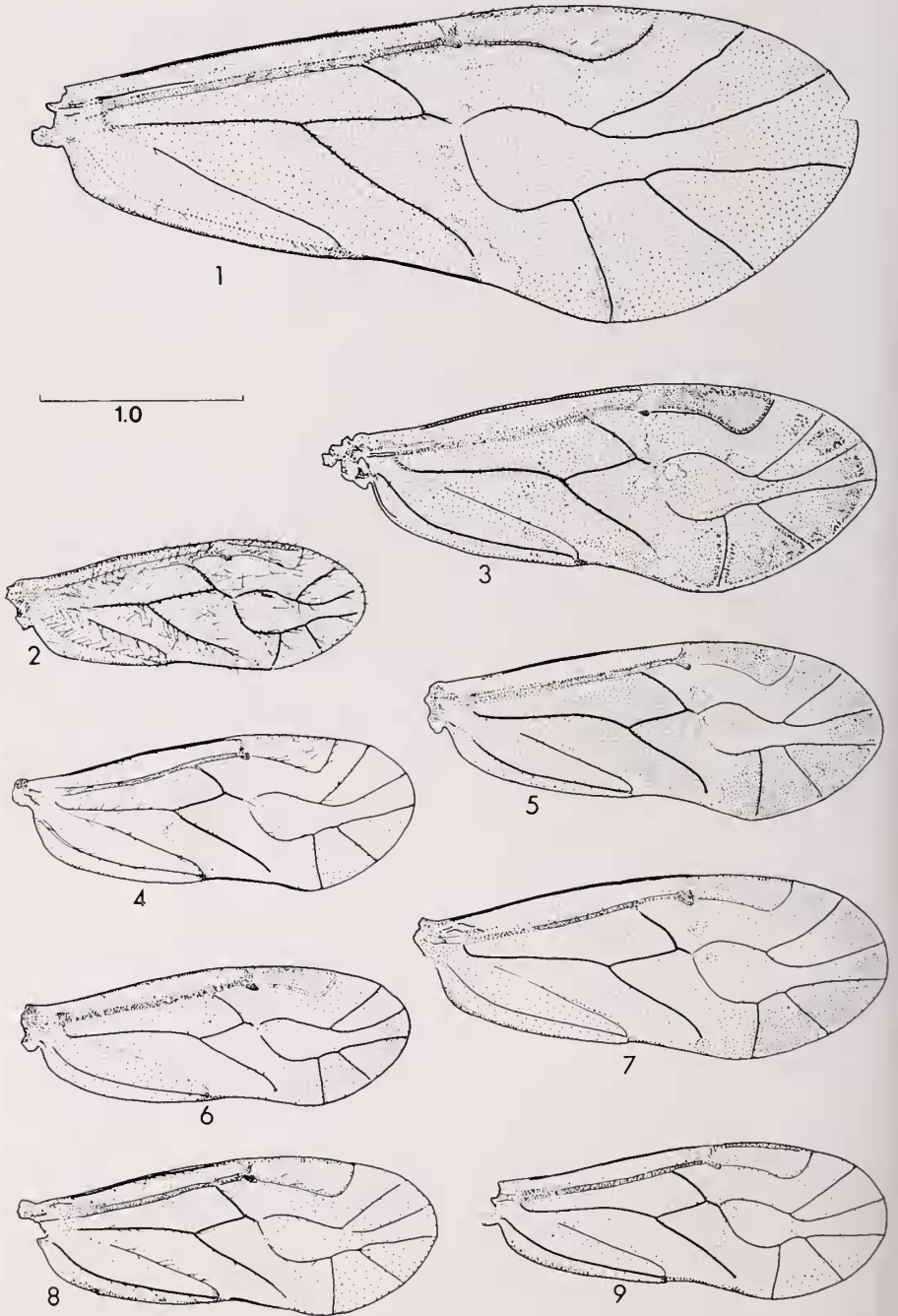
chpterous. In this species the females are smaller in general than males. Also, in all species observed the pigmented area of the subgenital plate covers the median apical lobe, a broad region basal to the lobe, and extends forward as a pair of slender, antero-laterally directed arms. Generally a more pigmented central region or pair of regions may be noted within the pigmented area.

Measurements (Table 1) were taken on whole specimens mounted temporarily in glycerine on a well slide. Forewing lengths were taken at 42 \times , at which the micrometer unit equals 17.4 μ . All other measurements were taken at 120 \times , at which the micrometer unit equals 6.2 μ .

Material examined is principally from the collection of the senior author. Material was also borrowed from the Canadian Department of Agriculture, Ottawa, Ontario, Canada.

KEY TO SPECIES OF *Kaestneriella*

1. Forewing ciliation consisting of minute sparse setae on veins, anterior margin, and surface of pterostigma; the marginal setae visible above 70 \times ; large setae, if any, limited to vein R and the part of R₁ forming posterior margin of pterostigma 5
Forewing ciliation distributed as above but consisting of abundant setae readily visible at 70 \times 2
2. Clypeus marked with a conspicuous large pair of spots formed by the striations **maculosa**, n.sp.
Clypeus with no conspicuous marking 3
3. Small species, forewings about 2.0 mm; known mostly from females in southern Mexico and Guatemala (coastal plain to 7,000 ft.) **setosa**, n.sp.
Males frequent, species from higher elevations of Guatemala or from further south 4
4. Large species, male forewings 4.0 mm; species from over 9,000 ft. in Guatemala **guatemalensis**, n.sp.
Small species, male forewings 2.5 mm; species from Costa Rica **pilosa** Roesler
5. Radular sclerites (δ) a simple pair of hook-shaped structures with a pair of small rounded sclerites lateral to bases of hooks (figs. 14, 17, and 21) 6
Radular sclerites three pairs of prongs 8
6. With a distinct pair of large spots on clypeus formed by lineations; setae conspicuous at 70 \times on vein R and on R₁ bordering pterostigma posteriorly **minor**, n.sp.
Clypeus with no distinct marks; setae of veins R and R₁ inconspicuous at 70 \times 7
7. Female forewing uniformly tawny brown in distal one-third; three colorless spots around R-M junction large (fig. 9). Male forewings 2.10 mm or less in length **pacifica**, n.sp.
Female forewing with darker regions in distal portions of cells R₁, R₃, R₅, M₁, M₂, and M₃. Male forewings 2.78 mm or more in length **obscura**, n.sp.
8. Middle pair of prongs of radular sclerites developed same as basal pair, being long and slender; a distinct dark spot just distad of colorless spot in base of cell R₅ **occidentalis**, n.sp.
Middle pair of prongs of radular sclerites much shorter and stouter than basal pair; region just distad of colorless spot in base of cell R₅ concolorous with surrounding tawny cuticle **mexicana**, n.sp.



Kaestneriella guatemalensis, n.sp.

DIAGNOSIS. Forewing ciliation very conspicuous in females, much less so in males, but in latter readily visible at 70 \times . Male radular sclerites consisting principally of a pair of elongate, curved structures each terminating posteriorly in a narrow, bent, acuminately pointed hook. Females brachypterous, the forewings not reaching tip of abdomen.

MALE. Measurements, Table 1.

MORPHOLOGY. R_2 index = 1.17. Phallosome (Fig. 12) broad and of approximately equal width near basal and near distal end; pore-bearing parameres indistinct at their bases, their tips falling well short of apical beak of phallosome, the pores very sparse and seen mostly in distal half of paramere. Apical beak of phallosome rather long and slender. Radular sclerites (Fig. 11) a pair of elongate structures curving toward mid-line at bases and outward posteriorly, each ending posteriorly in a narrow, bent, sharply pointed hook; to side of each of these a rounded sclerite. Clunial comb (Fig. 10) straight with several small denticles forming submarginal row and scattered smaller denticles before that; larger denticles of marginal row 14 and 20 in number on two specimens counted.

COLOR (in alcohol). Body coloration essentially same as in *K. obscura* but darkened areas of vertex showing slight spotting. Forewings (Fig. 1) uniformly washed with grayish-brown except for very slight development of colorless areas around R-M junction of forewing and large colorless area at distal end of vein Cu_1 ; membrane bordering vein M_3 of forewing with slightly darker pigmentation.

FEMALE. Measurements, Table 1.

MORPHOLOGY. Brachypterous; forewings extending to seventh abdominal segment at rest. R_s fork about even with stem in length. Subgenital plate (Fig. 32) with a slender, transverse darkly pigmented central area somewhat constricted mesally; median apical lobe of subgenital plate decidedly longer than its width at base, decidedly tapering from base to apex, the apex truncated and bearing a few long setae toward each of its lateral angles. Ovipositor valvulae (Fig. 31): first valvula slender, slightly bent upward at apex, the subapical region beset on medio-ventral side with rather sparse, minute setae. Second and third valvulae typical of the genus. Sensory cushion of paraproct with 12 and 19 trichobothria in two specimens counted; one trichobothrium decidedly larger than others and issuing from a larger basal rosette.

COLOR (in alcohol). Body essentially same as in male, but darkened areas of vertex much more discretely spotted. Forewings with colorless spots around R-M junction greatly en-

←

FIGS. 1-9. Forewings of *Kaestneriella*, all drawn at scale shown.

FIG. 1. *K. guatemalensis*, n.sp. ♂.

FIG. 2. *K. guatemalensis*, n.sp. ♀.

FIG. 3. *K. mexicana*, n.sp. ♀.

FIG. 4. *K. maculosa*, n.sp. ♀.

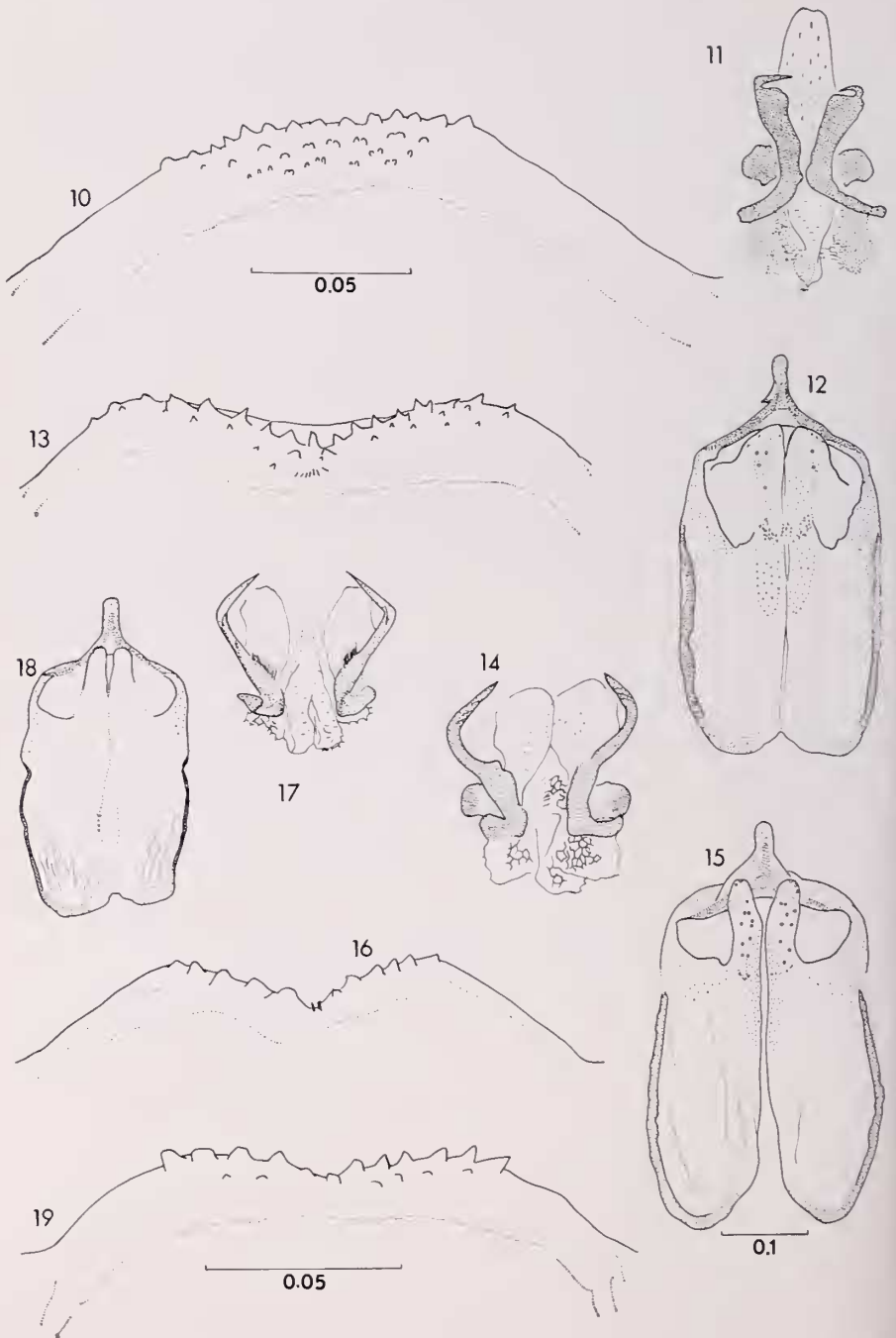
FIG. 5. *K. occidentalis*, n.sp. ♀.

FIG. 6. *K. minor*, n.sp. ♀.

FIG. 7. *K. obscura*, n.sp. ♀.

FIG. 8. *K. setosa*, n.sp. ♀.

FIG. 9. *K. pacifica*, n.sp. ♀.



larged, the anterior one covering most of width of cell R_1 , the middle one covering most of width of basal region of cell R_5 , the posterior one extending from region immediately posterior to R-M junction back to wing margin at distal end of vein Cu_1 .

VARIATION. In addition to the marked sexual dimorphism in wing length, males are in general decidedly larger than females. The sexual dimorphism in compound eye diameter is not very pronounced. Observed color variation in age-related.

RANGE. Highlands of Guatemala, taken at two localities, one at 9,500 feet and the other at 12,000 feet in elevation.

TYPE LOCALITY. 17 miles north of Huehuetenango (Hwy. 9), Dept. of Huehuetenango, Guatemala, September 2-3, 1968, E. L. Mockford and A. Garcia Aldrete collectors, holotype ♂, allotype ♀, 4 ♂ and 12 ♀ paratypes. Types are in the collection of the senior author.

RECORDS. Guatemala: 34 miles northwest of Sololá (Inter-Amer. Hwy., Dept. of Totonicapan).

HABITAT. Foliage of *Cupressus*.

Kaestneriella maculosa, n.sp.

DIAGNOSIS. Forewing ciliation abundant and conspicuous. Male radular sclerotization in form of pair of sclerites each bearing three postero-mesally directed blades. Clypeus marked by conspicuous pair of large brown spots formed by the striations.

MALE. Measurements, Table 1.

MORPHOLOGY. R_5 index = 1.32. Phallosome (Fig. 24) broadest near its posterior end, tapering somewhat towards base. Pore-bearing parameres long, slender, diverging somewhat, with pores only in their distal halves. Apical beak of phallosome long, pointed at tip. Radula (Fig. 23) of two sclerotized regions each giving rise to three slender, posteriorly-directed blades; anterior pair of blades very slender, directed somewhat mesally; middle pair of blades shortest and somewhat stouter than anteriors, also directed somewhat mesally; posterior pair of blades pointing directly posteriorly, about same length as anteriors but stouter. Clunial comb (Fig. 22) of 13 small denticles on single specimen observed.

←

FIGS. 10-19. Genitalia of *Kaestneriella*.

FIG. 10. *K. guatemalensis*, n.sp. ♂, clunial comb.

FIG. 11. *K. guatemalensis*, n.sp. ♂, radular sclerites (twice scale of Fig. 15).

FIG. 12. *K. guatemalensis*, n.sp. ♂, phallosome (scale of Fig. 15).

FIG. 13. *K. obscura*, n.sp. ♂, clunial comb (scale of Fig. 19).

FIG. 14. *K. obscura*, n.sp. ♂, radular sclerites (twice scale of Fig. 15).

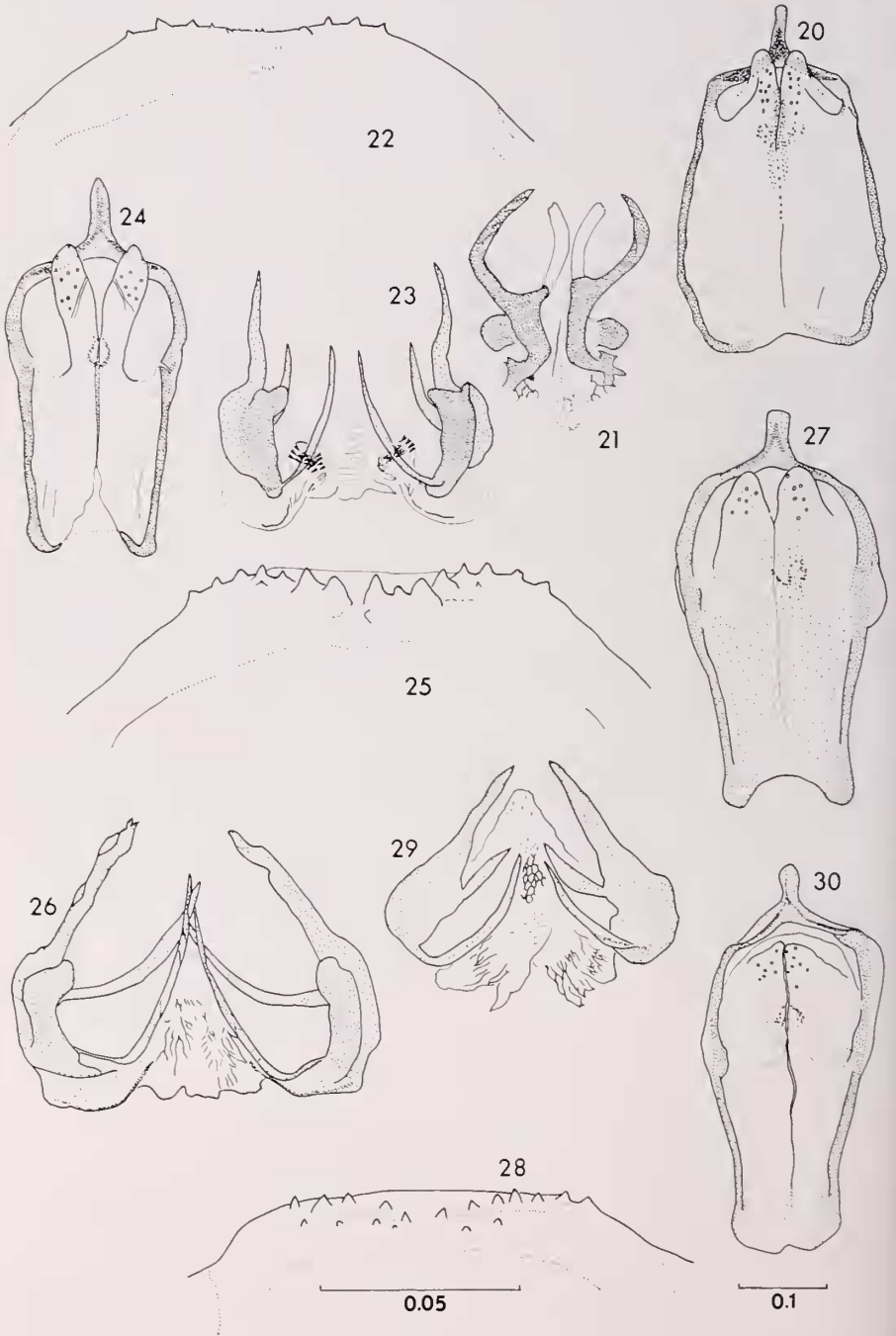
FIG. 15. *K. obscura*, n.sp. ♂, phallosome.

FIG. 16. *K. pacifica*, n.sp. ♂, clunial comb (scale of Fig. 19).

FIG. 17. *K. pacifica*, n.sp. ♂, radular sclerites (twice scale of Fig. 15).

FIG. 18. *K. pacifica*, n.sp. ♂, phallosome (scale of Fig. 15).

FIG. 19. *K. minor*, n.sp. ♂, clunial comb.



COLOR (in alcohol). Head and thorax chiefly dull yellowish-white, marked by medium brown cuticular pigment as follows: three pairs of spots on vertex of head—one pair behind compound eyes, one pair mesad of compound eyes and behind level of ocellar interval, one pair bordering epicranial suture; one pair of spots on post-clypeus, formed by the striations; a spot along ventral margin of each gena. Thoracic tergal lobes marked with medium brown, the brown areas separated by broad areas of dull yellowish white bordering sutures; thoracic pleura lacking brown markings. Antennae and legs pale brown. Preclunial abdominal segments colorless in cuticle, each segment with a ring of subcuticular purplish-brown pigment, the rings appearing double due to partial inclusion of a narrow white ring within each colored ring. The rings interrupted along dorsal and ventral midlines. Clunium pale brown in cuticle, marked with a dorsal and two lateral purplish brown subcuticular pigment spots. Phallosome medium brown; epiproct and paraprocts pale brown. Wings faintly washed with grayish-brown. Ocellar interval dark brown; compound eyes black.

♀. Measurements, Table 1.

MORPHOLOGY. R_s fork in forewing slightly longer than stem. R_s index = 1.38. Subgenital plate (Fig. 39) with slightly darkened central region below median apical lobe; median apical lobe decidedly longer than broad, its distal angles rounded and each bearing three long setae and two or three shorter ones. Ovipositor valvulae (Fig. 38): first valvula broadened in middle, slightly upcurved at tip, subapical region beset with a few minute setae. Second and third valvulae typical of the genus. Sensory cushion of paraproct with 20 and 22 trichothoria on two sides of single specimen counted.

COLOR (in alcohol). Same as in male, but brown marks somewhat darker; ventral interruption of abdominal color rings wide; forewings (Fig. 4) marked as follows: wide cloudy brown band bordering distal margin from vein R_{2+3} nearly to Cu_1 , cloudy brown spot in basal region (not covering extreme base) of cell R_3 , cloudy brown spot covering base of R-M junction and extending well back into cell M_3 , pale cloudy brown spot in cell Cu_1 anterior to nodulus, another such spot in base of cell Cu_1 extending posteriorly into bases of cells Cu_2 and IA.

VARIATION. There appears to be sexual dimorphism in forewing length. Geographic variation in size is suggested by the data, the single male from Oaxaca being considerably larger than the two males from San Luis Potosi.

RANGE. Known from only three localities, two in central and one in southern Mexico, at elevations of from 4,500 to 7,000 feet.

←

FIGS. 20–30. Genitalia of *Kaestneriella*.

FIG. 20. *K. minor*, n.sp. ♂, phallosome (scale of Fig. 30).

FIG. 21. *K. minor*, n.sp. ♂, radular sclerites (twice scale of Fig. 30).

FIG. 22. *K. maculosa*, n.sp. ♂, clunial comb (scale of Fig. 28).

FIG. 23. *K. maculosa*, n.sp. ♂, radular sclerites (twice scale of Fig. 30).

FIG. 24. *K. maculosa*, n.sp. ♂, phallosome (scale of Fig. 30).

FIG. 25. *K. mexicana*, n.sp. ♂, clunial comb (scale of Fig. 28).

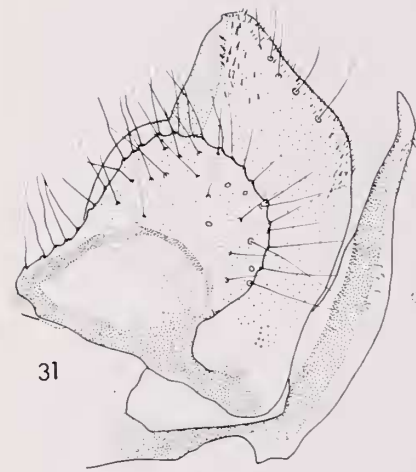
FIG. 26. *K. mexicana*, n.sp. ♂, radular sclerites (twice scale of Fig. 30).

FIG. 27. *K. mexicana*, n.sp. ♂, phallosome (scale of Fig. 30).

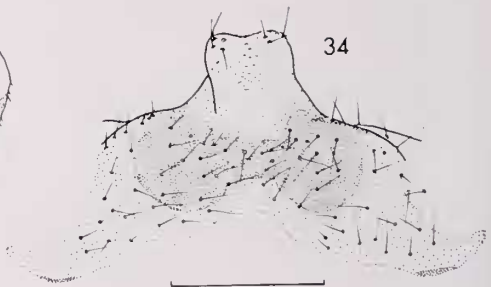
FIG. 28. *K. occidentalis*, n.sp. ♂, clunial comb.

FIG. 29. *K. occidentalis*, n.sp. ♂, radular sclerites (twice scale of Fig. 30).

FIG. 30. *K. occidentalis*, n.sp. ♂, phallosome.

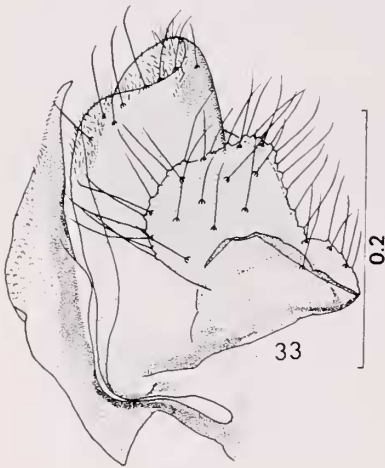


31



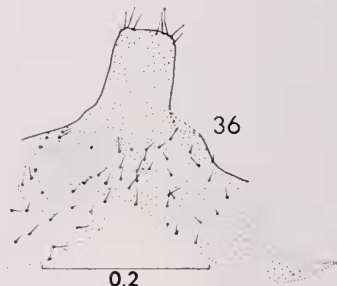
34

0.2



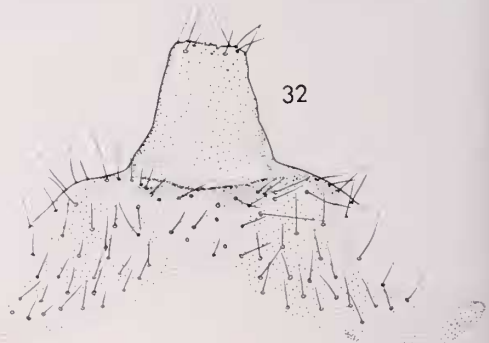
33

0.2

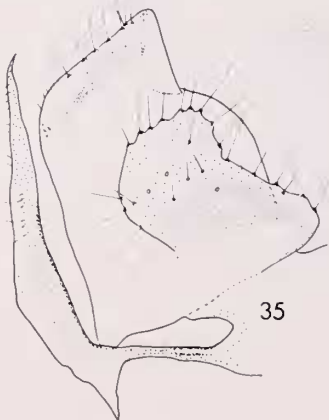


36

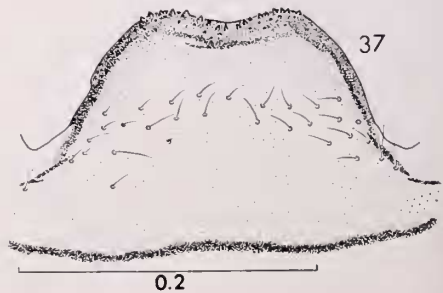
0.2



32



35



37

0.2

TYPE LOCALITY. Hidalgo, San Luis Potosi, Mexico, September 2, 1958, E. L. Mockford collector, holotype ♂ and 1 ♂ paratype. Types are in the collection of the senior author.

RECORDS. Mexico: Oaxaca: 5 miles south of Nochixtlan. San Luis Potosi: 8 miles east of Huizache (Hwy. 80) (allotype).

HABITAT. This species has been taken on various desert shrubs.

Kaestneriella obscura, n.sp.

DIAGNOSIS. Forewing ciliation inconspicuous. Male radular sclerites consisting principally of a pair of hooks. Clypeal striations not coalescing to form a pair of spots. Female forewings (except for usual pale areas) tawny brown with darker brown markings in distal one-third. Male forewings 2.89 mm or more in length.

MALE. Measurements, Table 1.

MORPHOLOGY. R_5 index = 1.21. Phallosome (Fig. 15) broad and approximately as wide basally as distally; pore-bearing parameres distinct at their bases, their tips falling short of apical beak of phallosome, the pores scattered along entire length of each paramere. Membranous area bordered by side of aedeagal arch and pore-bearing paramere approximately triangular, small; apical beak short. Radular sclerites (Fig. 14) a pair of hook-shaped structures pointed distally, with a small pair of rounded sclerites, one attached laterally to the base of each hook-shaped sclerite. Clunical comb (Fig. 16) incurved mesally, with at least a few minute denticles forming a submarginal row; the larger denticles of the marginal row 17 and 18 in number on two specimens counted.

COLOR (in alcohol). Ground color (probably from underlying muscles showing through cuticle) dull yellowish-white overlain by dusky brown cuticular pigment on head, thorax, appendages and tip of abdomen in pattern as follows: on head a broad band bordering epicranial suture, posterior margin of vertex and orbits from posterior margin of vertex to level of ocellar interval; postclypeus faintly striated with dusky brown. Labrum, ocellar interval, and spot in front of ocellar interval dark brown. Antennae, maxillary palpi and legs except tibiae and ventral surfaces of femora dusky brown. Tibiae dark brown; ventral surfaces of femora dull yellowish-white. Thoracic notal lobes dusky brown except of ground color along sutures and in central part of metascutum. Thoracic pleura pale dusky brown, darkening somewhat ventrally. Abdomen with broad annulations of purplish-brown subcuticular pigment, except dusky brown (cuticular pigment) on clunium, phallosome, epiproct, and paraprocts. Wings uniformly washed with dusky brown. Compound eyes black.

FEMALE. Measurements, Table 1.

←

FIGS. 31-37. Genitalia of *Kaestneriella*.

FIG. 31. *K. guatemalensis*, n.sp. ♀, ovipositor valvulae (scale of Fig. 33).

FIG. 32. *K. guatemalensis*, n.sp. ♀, subgenital plate (scale of Fig. 36).

FIG. 33. *K. obscura*, n.sp. ♀, ovipositor valvulae.

FIG. 34. *K. obscura*, n.sp. ♀, subgenital plate.

FIG. 35. *K. pacifica*, n.sp. ♀, ovipositor valvulae (scale of Fig. 33).

FIG. 36. *K. pacifica*, n.sp. ♀, subgenital plate (slightly damaged in mounting).

FIG. 37. *K. obscura*, n.sp. ♂, clunium in dorsal view showing comb.

MORPHOLOGY. R_s fork in forewing somewhat longer than stem. R_s index = 1.21. Subgenital plate (Fig. 34) with single broad, darkly pigmented central area somewhat constricted mesally; median apical lobe of subgenital plate somewhat longer than wide, each of its distal angles beset with three long setae and one or two shorter ones. Ovipositor valvulae (Fig. 33): first valvula somewhat broadened in middle, very slightly upcurved at apex, the subapical region beset on medio-ventral side with numerous minute setae. Second and third valvulae typical of the genus. Sensory cushion of paraproct with more or less 21 trichobothria.

COLOR (in alcohol). Body and appendage coloration differing from that of male only in that darkened areas of vertex not continuous but broken up into numerous discrete spots, and those around orbits extending more anteriorly. Forewings (Fig. 7) largely dusky brown but with usual colorless areas around R-M junction and a colorless spot at distal end of Cu_1 . Darker brown pigmentation present in submarginal regions of Cells R_1 , R_3 , R_5 , M_1 , M_2 and M_3 .

VARIATION. Sexual dimorphism in wing length and compound eye size is pronounced. Variation is noted in extent of development of the dark submarginal pigmentation of the forewing. Paler individuals lack this pigment.

RANGE. Middle elevation in central Mexico.

TYPE LOCALITY. 6 miles east of Tulancingo, Highway 130, Hidalgo, Mexico, June 24, 1962, E. L. Mockford, J. M. Campbell, and F. Hill, collectors, holotype δ , allotype φ , and 5 δ paratypes. Types are in the collection of the senior author.

RECORDS (Fig. 58). Mexico: Guanajuato: 25 miles south of San Luis de la Paz (Hwy. 57). Hidalgo: 15 miles west of Huachinango (Hwy. 130); 4 miles southwest of Rancho Viejo (Hwy. 85); 10 miles west of Jacala (Hwy. 85). Michoacan: 4 miles east of Carapan (Hwy. 15); 17 miles east of Zacapu (Hwy. 15). Puebla: 5-6.3 miles southwest of Teziutlan. Veracruz: 4 miles west of Jalacingo (Hwy. 131).

HABITAT. This species has been taken principally on branches of oaks (*Quercus* spp.) and alder (*Alnus* sp.), but also on other broadleaved trees and on juniper (*Juniperus* spp.), and pine (*Pinus* spp.).

Kaestneriella mexicana, n.sp.

DIAGNOSIS. Forewing ciliation inconspicuous; male radular sclerotization in form of two elongate sclerites each giving rise to three blades, all directed posteromesally. The basal two pairs of blades slender, curving toward and meeting at mid-line. Cell R_5 in forewing with several pale or colorless spots distad of basal one.

MALE. Measurements, Table 1.

MORPHOLOGY. R_s index = 1.11. Phallosome (Fig. 27) widest near distal end, tapering toward base; pore-bearing parameres indistinct at their bases, the pores apparently not extending to their bases; these parameres not attaining base of apical beak of phallosome; apical beak short. Radular sclerites (Fig. 26) as described in diagnosis, the distal pair of blades straight and somewhat stouter than other two pairs. Clunial comb (Fig. 25) very slightly indented toward mid-line, with break in sclerotization in middle; a few minute submarginal denticles present (2, 3, and 5 in three observed specimens): 13, 15, and 15 denticles in marginal row of three observed specimens.

COLOR (in alcohol). Essentially same as in *K. obscura*, n.sp., but brown markings in general somewhat lighter, tibiae decidedly lighter, band bordering epicranial suture mottled and forewings marked exactly as in female (see below).

FEMALE. Measurements, Table 1.

MORPHOLOGY. R_s fork in forewing about same length as its stem, R_5 index = 1.15. Subgenital plate (Fig. 50) with small, compact, darkly-pigmented central area; median apical lobe about as long as broad, each of its distal angles beset with several setae of various lengths. Ovipositor valvulae (Fig. 49): first valvula slender, slightly upcurved at tip, subapical region on medio-ventral side with numerous minute setae; second and third valvulae typical of the genus. Sensory cushion of paraproct with more or less 23 trichobothria.

COLOR (in alcohol). Essentially as in male. Forewing (Fig. 3) washed over most of surface with reddish-brown, darkest in pterostigma and in submarginal band from cell R_1 through cell M_3 . Usual trio of colorless spots around R-M junction. Cell R_5 with, in addition to its basal clear spot, one or two clear spots about half-way along its length near its posterior border. Pale region anterior to point of R_5 fork. Colorless spot at distal end of vein Cu_1 .

VARIATION. Sexual dimorphism exists in forewing length and compound eye diameter. Males show considerable variation in compound eye diameter, those from higher elevations tending to have smaller compound eyes than those from lower elevations (Fig. 55).

RANGE. Mountains of central Mexican states of Mexico, Morelos, Puebla, Durango, Sinaloa, and Michoacan at elevations of 7,000 to 10,000 feet.

TYPE LOCALITY. Mexico-Tlaxcala State Line on Highway 136 (Continental Divide), Mexico, Mex., July 3, 1962, E. L. Mockford, J. M. Campbell, and F. Hill, collectors, holotype ♂, allotype ♀, 2 ♂ and 6 ♀ paratypes. Same locality, August 20, 1958, 2 ♀ paratypes.

RECORDS (Fig. 57). Mexico: Durango: 20 miles west of Cd. Durango (Hwy. 40); 20 miles east of El Salto (Hwy. 40); 4 miles west of El Salto (Hwy. 40). Mexico: 9.6 and 12 miles west of Rio Frio (Hwy. 190). Michoacan: 10 miles west of Zinapicuaro (Hwy. 15). Morelos: mountains outside Cuernavaca. Puebla: 34 miles west of Acultzingo (Veracruz, Hwy. 150). Sinaloa: 12 miles east of Santa Lucia (Hwy. 40).

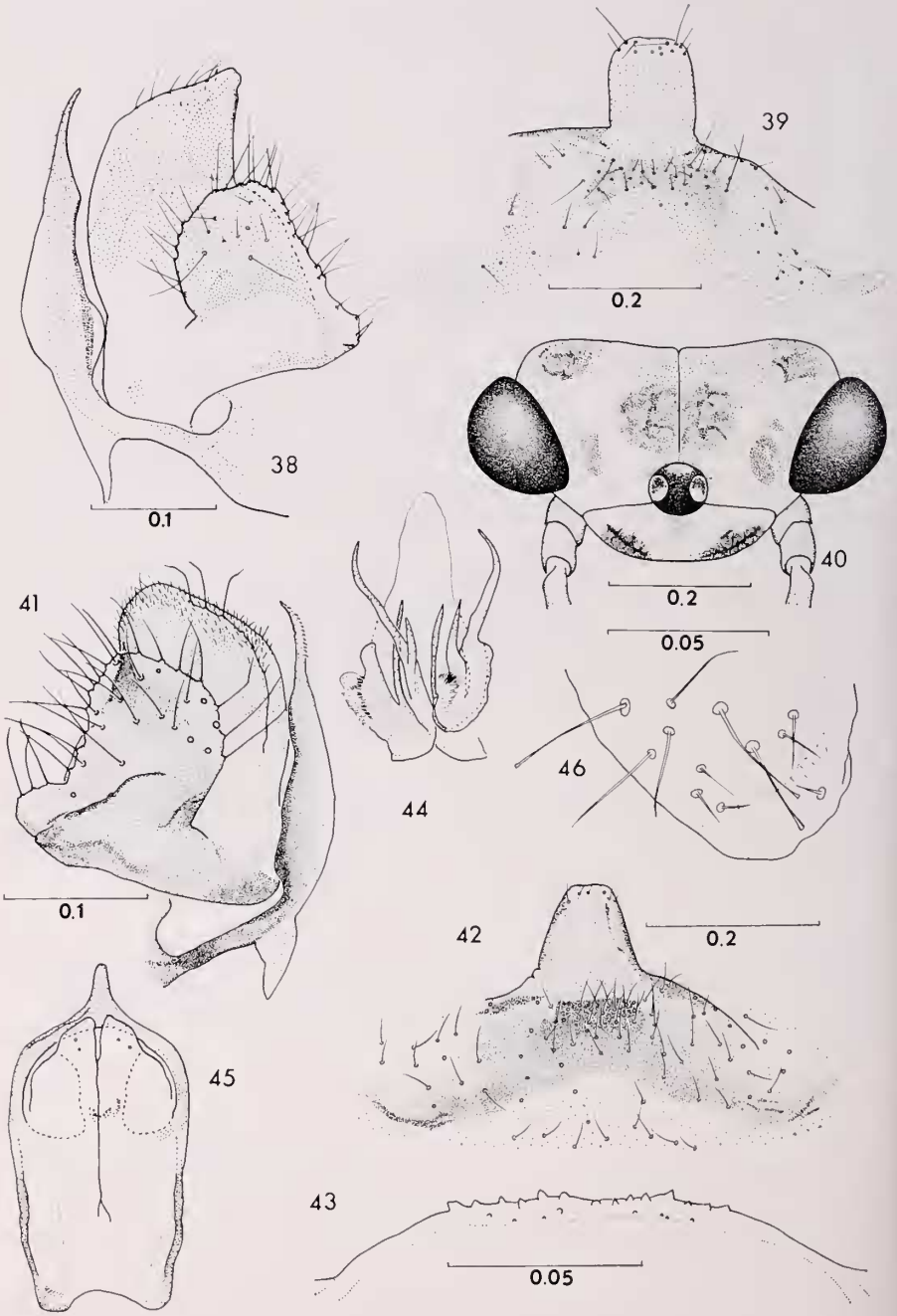
HABITAT. This species has been taken primarily on branches of oaks (*Quercus* spp.), but also on madrone (*Arbutus* sp.), other broad-leaved trees and shrubs, piñon pine (*Pinus cembroides*), cypress (*Cupressus* sp.), and firs (*Abies* sp.).

Kaestneriella minor, n.sp.

DIAGNOSIS. Forewing ciliation inconspicuous except for large setae on vein R and on posterior margin of pterostigma. Male radular sclerites consisting of a pair of curved hooks with a pair of small, rounded sclerites to the sides of the hooks. Clypeal striations forming a pair of large spots.

MALE. Measurements, Table 1.

MORPHOLOGY. R_5 index = 1.27. Phallosome (Fig. 20) broad and approximately as wide near base as near apex; pore-bearing parameres indistinct at their bases, their tips reaching base of apical beak of phallosome, the pores occurring not quite to tip of each paramere;



membranous area bordered by side of aedeagal arch and pore-bearing paramere rather long and narrow, somewhat widened near its base; apical beak long. Radular sclerites (Fig. 21) a pair of hook-shaped structures pointed distally, with a pair of small rounded sclerites, one lateral to the base of each hook-shaped sclerite and probably attached to the hook-shaped sclerite by a membrane. Clunial comb (Fig. 19) incurved mesally, with a few small denticles forming submarginal row, the longer denticles of the marginal row 12 and 17 in number in two specimens counted; lateral denticle of each side directed outward.

COLOR (in alcohol). Ground color of body as in *K. obscura*. Vertex with pair of dark brown spots, one on each side of, not touching, epicranial suture. Ocellar interval and area immediately bordering it dark brown. Post-clypeus bearing pair of dorso-ventrally elongated medium brown spots within which darker brown striations visible. Each gena with a pale brown spot along its ventral margin. Clypeus dark brown. Antennae, maxillary palpi and legs pale brown. Mesoprescutum medium brown except for ground color bordering its posterior suture and narrow band of ground color along its dorsal mid-line. Lateral lobes of mesoscutum dark brown, separated by ground color along mid-line, this ground color continuous anteriorly with that along suture delimiting prescutum and posteriorly with ground color covering entire mesoscutellum. Prescutum and scutellum of metatergum of ground color, the lateral lobes of scutum dark brown. Thoracic pleura of ground color except for purplish-brown spot below each wing. Preclunial abdominal segments colorless except for narrow purplish-brown bands of subcuticular pigment over dorsal surface of each segments 1 through 6, three spots of same color on segment 7 marking lateral limits of band of other segments and dorsal mid-line, a dorso-ventrally elongated spot of same color around each spiracle of segment 2 through 7, and a narrow ventral band connecting lateral spiracular spots on segments 4, 5, and 6. Clunium and epiproct dark brown, paraprocts and phallosome medium brown. Forewings uniformly washed with pale gray except for very small colorless areas in usual positions around R-M junction and small colorless area at distal end of vein Cu₁. Compound eyes black.

FEMALE. Measurements, Table 1.

MORPHOLOGY. Rs fork in forewing very slightly longer than stem. R₅ index = 1.63. Subgenital plate (Fig. 52) with pair of darkly pigmented central areas narrowly separated along mid-line; median apical lobe of subgenital plate about as long as wide, rounded distally, bearing laterally at apex a few setae, the lateral ones (3 each side) longer than mesal pair. Ovipositor valvulae (Fig. 51): first valvula slender, bent upward at apex, the subapical region beset on medio-ventral side with numerous minute setae. Second and third valvulae typical of the genus. Sensory cushions of paraproct with 15 and 18 ctenidiobothria on two sides of single specimen counted.

COLOR (in alcohol). Body color differing from that of male only in having somewhat wider

←

FIGS. 38-46. Genitalia and other parts of *Kaestneriella*.

FIG. 38. *K. maculosa*, n.sp. ♀, ovipositor valvulae.

FIG. 39. *K. maculosa*, n.sp. ♀, subgenital plate (slightly damaged in mounting).

FIG. 40. *K. maculosa*, n.sp. ♂, head, dorsal view.

FIG. 41. *K. setosa*, n.sp. ♀, ovipositor valvulae.

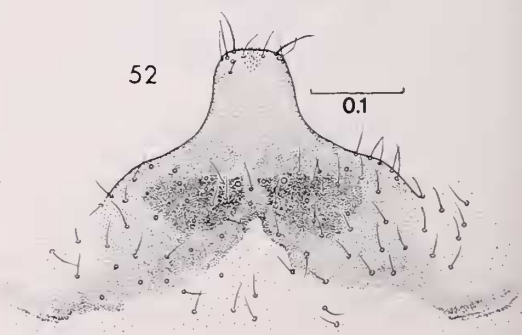
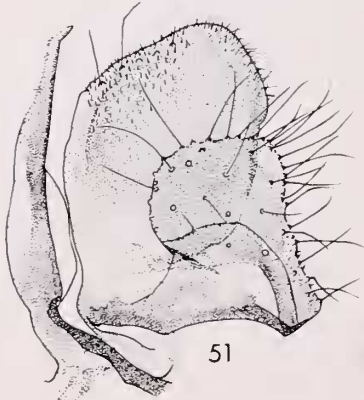
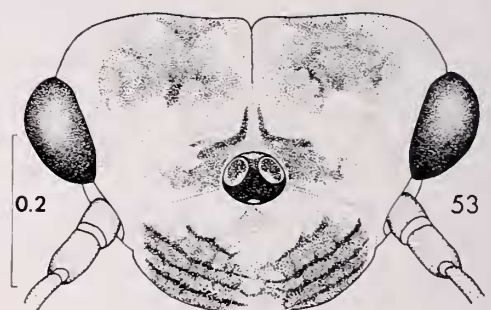
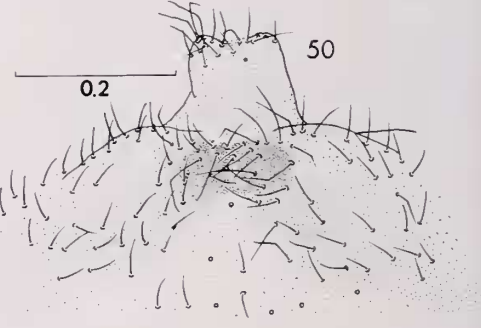
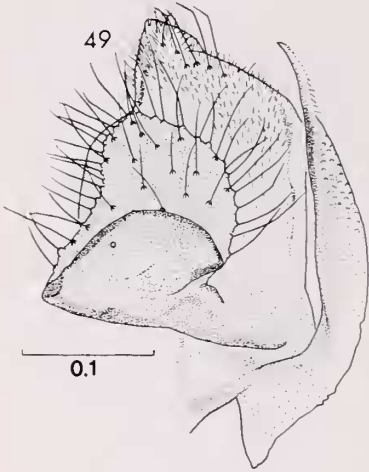
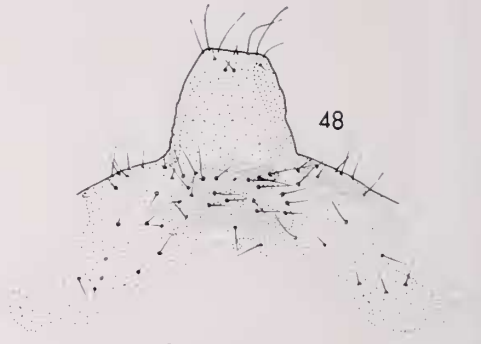
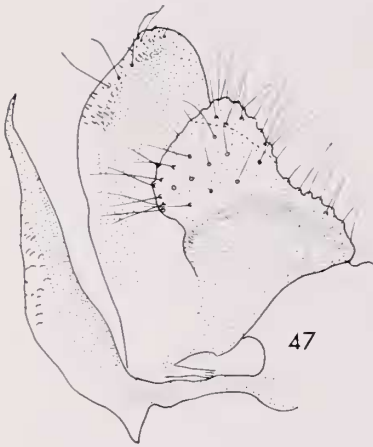
FIG. 42. *K. setosa*, n.sp. ♀, subgenital plate.

FIG. 43. *K. setosa*, n.sp. ♂ (?), clunial comb.

FIG. 44. *K. setosa*, n.sp. ♂ (?), radular sclerites (twice scale of Fig. 42).

FIG. 45. *K. setosa*, n.sp. ♂ (?), phallosome (scale of Fig. 42).

FIG. 46. *K. occidentalis*, n.sp. ♂, ventral end of paraproct showing clubbed setae.



bands of purplish brown on dorsal surfaces of abdominal segments 1 through 6, such a band present on segment 7 instead of three spots; these bands at least narrowly joined to spots around spiracles except on segment 7; these bands continuous ventrally beyond spiracles on segments 2, 3, 4, and 5, but broadly interrupted along mid-line. Pigmented area of subgenital plate dark brown. Forewings with larger colorless areas around R-M junction.

VARIATION. Sexual dimorphism is pronounced in compound eye size and forewing length. Variation is noted in coloration of seventh abdominal segment of females, some specimens having three pigment spots, as in males, instead of a band.

RANGE. Central Mexico and Pacific slopes from Chiapas to Nayarit.

TYPE LOCALITY. 9 miles south of Izucar de Matamoros (Hwy. 190), Puebla, Mexico, August 17, 1968, A. Garcia Aldrete collector, holotype ♂ and 1 ♂ paratype. Types are in the collection of the senior author.

RECORDS (Fig. 58). Mexico: Chiapas: 2.3 miles west of Las Cruces (Hwy. 190); 8 miles south of Las Cruces Junction (Hwy. 195). Guerrero: Mexcala to 10 miles north of Mexcala (Hwy. 95); 8 miles north of Zumpango del Rio (Hwy. 95). Nayarit: 21 miles southeast of Tepic. Oaxaca: 40 miles south of Oaxaca City (Hwy. 190) (allotype). San Luis Potosi: Hidalgo.

HABITAT. This species has been taken from shrubs and small trees in arid and semi-arid areas.

Kaestneriella occidentalis, n.sp.

DIAGNOSIS. Forewing ciliation inconspicuous. Male radular sclerotization in form of two elongate sclerites each produced into a slender blade posteriorly and each giving rise near its base to two blades on the median side directed postero-medially. The more basal of these two blades slender and curved, the more distal blade short, straight, and stout. Cell R_5 in forewing with only one pale spot, the basal one; generally with a dark spot immediately apicad of the pale spot.

MALE. Measurements, Table 1.

MORPHOLOGY. R_5 index = 1.22. Phallosome (Fig. 30) essentially same as in *K. mexicana* but pore-bearing parameres somewhat shorter and anterior margin not emarginate. Radular sclerites (Fig. 29) as described in diagnosis, the distal pair of blades straight and somewhat

←

FIGS. 47-53. Genitalia and other parts of *Kaestneriella*.

FIG. 47. *K. occidentalis*, n.sp. ♀, ovipositor valvulae (scale of Fig. 49).

FIG. 48. *K. occidentalis*, n.sp. ♀, subgenital plate (scale of Fig. 50).

FIG. 49. *K. mexicana*, n.sp. ♀, ovipositor valvulae.

FIG. 50. *K. mexicana*, n.sp. ♀, subgenital plate.

FIG. 51. *K. minor*, n.sp. ♀, ovipositor valvulae (scale of Fig. 49).

FIG. 52. *K. minor*, n.sp. ♀, subgenital plate.

FIG. 53. *K. minor*, n.sp. ♀, head, dorsal view.

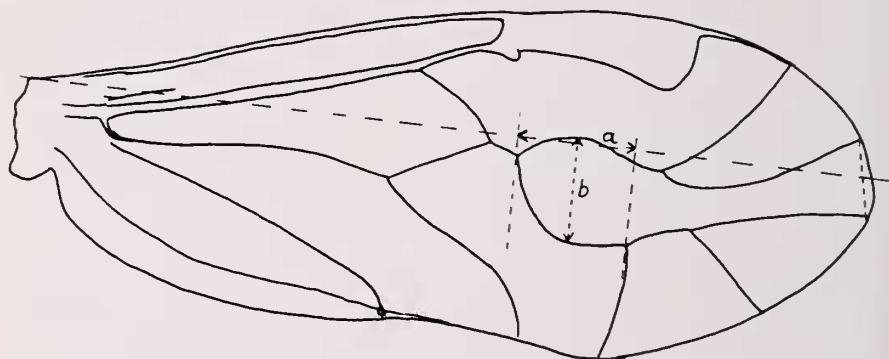


FIG. 54. Outline of forewing venation of *Kaestneriella obscura*, n.sp. ♀, showing lines constructed for determination of the R_5 index. Line segments a and b are measured.

stouter than other two pairs. Clunial comb (Fig. 28) curving inward toward mid-line, with a submarginal row of small denticles: 12 and 17 denticles in marginal row of two specimens observed.

COLOR (in alcohol). Not differing from *K. mexicana* except in forewing markings; the latter as described for female (see below).

FEMALE. Measurements, Table 1.

MORPHOLOGY. Essentially identical with *K. mexicana*, only differences noted being fewer minute setae near tip of first valvula and constriction near base of third valvula. R_5 index = 1.27.

COLOR (in alcohol). Essentially as described for *K. mexicana*, but brown regions of body reddish-brown instead of dusky; subcuticular pigment rings of abdomen reddish-brown instead of purplish-brown. Forewings (Fig. 5) essentially as described for *K. mexicana* differing as mentioned in diagnosis.

VARIATION. Females show variation in intensity of color of wings and body in the brown areas, probably related to age. Males on hand have decidedly lighter wing markings than in most females. Males from Durango (three specimens) are paler in brown areas of body than darker females but same as paler females; the single male from Oaxaca is dusky in brown areas. Sexual dimorphism exists in wing length and compound eye size.

RANGE. Known from the Mexican states of Durango, Michoacan, and Oaxaca.

TYPE LOCALITY. 20 miles west of Durango City on Hwy. 40, Durango, Mexico, July 16, 1963, E. L. Mockford and F. Hill, collectors, holotype ♂, allotype ♀, 1 ♂ and 15 ♀ paratypes. Types are in the collection of the senior author.

RECORDS (Fig. 57). Mexico: Durango: 19 miles northeast of Durango City (Hwy. 40). Michoacan: 4.5 miles east of Carapan (Hwy. 15). Oaxaca: 5 miles south of Nochixtlan (Hwy. 190).

HABITAT. This species has been taken on pines and on desert trees.

Kaestneriella pacifica, n.sp.

DIAGNOSIS. Forewing ciliation inconspicuous. Male radular sclerites consisting principally of a pair of hooks. Clypeal striations not coalescing to form a pair of spots. Female forewings uniformly tawny brown in distal one-third. Male forewings 2.11 mm or less in length.

MALE. Measurements, Table 1.

MORPHOLOGY. R_5 index = 1.38. Phallosome (Fig. 18) broad and approximately as wide basally as distally; pore-bearing parameres weakly sclerotized, the pores minute and indistinct; these parameres falling short of apical beak of phallosome; membranous area bordered by side of aedeagal arch and pore-bearing paramere rounded anteriorly, tapering posteriorly; apical beak long. Radular sclerites (Fig. 17) a pair of acuminate pointed hook-shaped structures each with a broadened base. Clunial comb (Fig. 16) incurved mesally with or without scattered submarginal denticles; 13 marginal denticles in each of the two specimens counted.

COLOR (in alcohol). Color pattern generally same as in *K. obscura*, but cuticular pigment generally lighter brown; clypeal striations dark brown and very narrow; purplish-brown subcuticular rings of abdomen somewhat narrower, hence wide colorless rings bordering each intersegmental line.

FEMALE. Measurements, Table 1.

MORPHOLOGY. R_s fork in forewing somewhat longer than stem. R_5 index = 1.54. Subgenital plate (Fig. 36) apparently with pair of darkly pigmented areas just basal to median apical lobe; the lobe much longer than broad and each of its distal angles beset with several short hairs. Ovipositor valvulae (Fig. 35): first valvula only very slightly broadened in middle, slightly upcurved at apex, the subapical region beset on medio-ventral side with a few minute setae. Second valvula typical of the genus. Third valvula somewhat longer and less wide than in most other species. Sensory cushion of paraproct with more or less 21 trichobothria.

COLOR (in alcohol). Same as in male except brown regions of vertex mottled; striations of post-clypeus indistinct, pale brown; forewing with usual pale spots around R-M junction, the spot above and the spot below junction relatively larger than in *K. obscura*; forewing otherwise uniformly washed with grayish-brown except for pale area at distal end of Cu_1 .

VARIATION. Slight sexual dimorphism exists in wing length and compound eye size.

RANGE. Known only from Nayarit and western Jalisco.

TYPE LOCALITY. 21 miles southeast of Tepic, Nayarit, Mexico, July 20, 1963, E. L. Mockford collector, holotype ♂, allotype ♀, 3 ♂, and 3 ♀ paratypes. The types are in the collection of the senior author.

RECORDS (Fig. 58). Mexico: Jalisco: 13 miles west of Guadalajara (Hwy. 15).

HABITAT. This species has been taken on various broad-leaved trees and shrubs, including oaks (*Quercus* spp.), and on pines (*Pinus* spp.).

Kaestneriella pilosa Roesler (♂)

Kaestneriella pilosa Roesler, 1943:10.

DIAGNOSIS. Forewing ciliation conspicuous. Male radular sclerites consisting

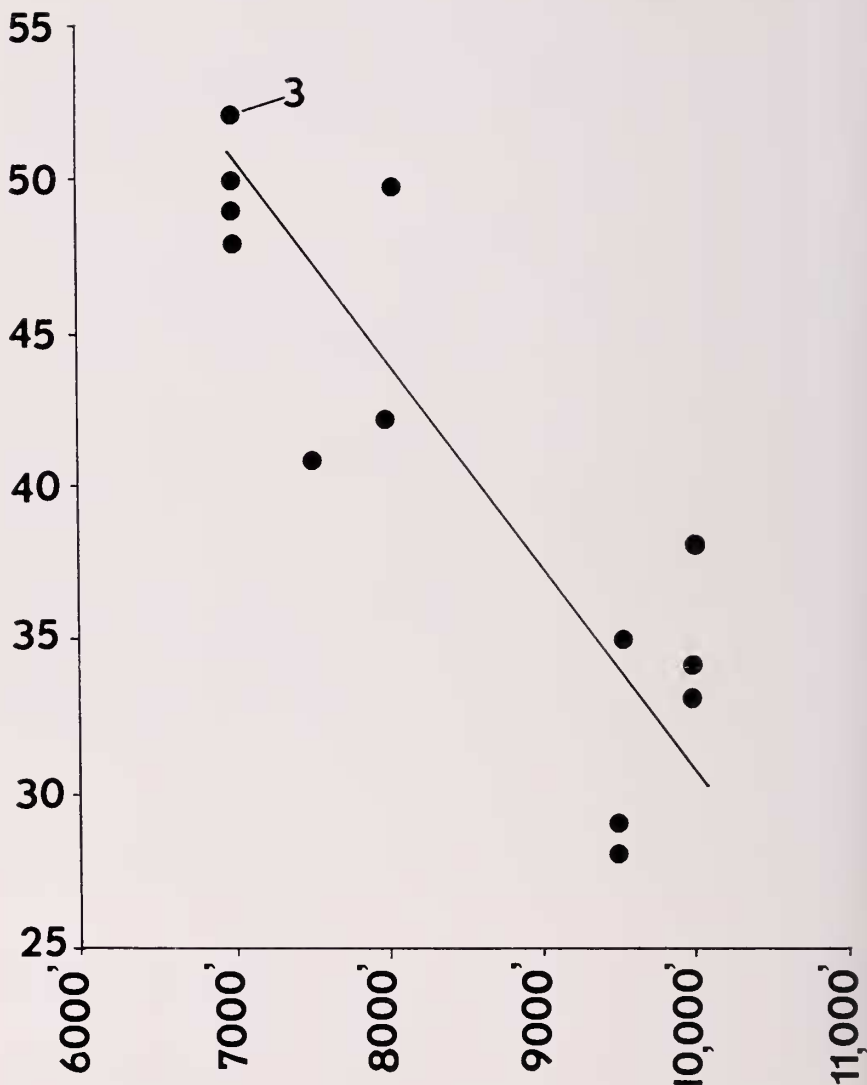


FIG. 55. Regression of antero-posterior eye diameter of males of *Kaestneriella mexicana*, n.sp. (y axis) on elevation in feet above sea level at which specimens were collected (x axis). Units of y axis = micrometer units at 120 \times (= 6.2 μ). Regression line fitted by Bartlett method.

principally of a pair of elongate structures each terminating posteriorly in a process bent mesally, the process apparently much wider than in *K. guatemalensis*.

We have seen no examples of this species.

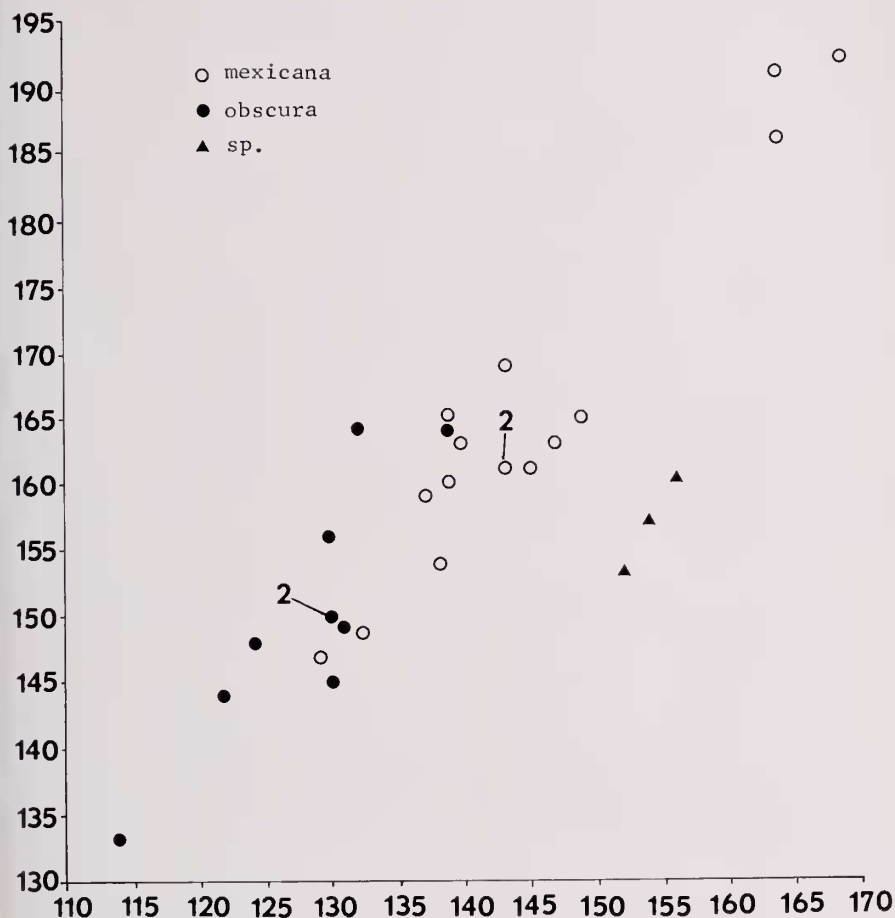


FIG. 56. Regression of Posterior tibial length (y axis, micrometer units at $120\times = 6.2 \mu$) on forewing length (x axis, micrometer units at $42\times = 17.4 \mu$) for females of *Kaestneriella mexicana*, n.sp., *K. obscura*, n.sp., and *K. sp.*

Kaestneriella setosa, n.sp. (♀)

DIAGNOSIS. Ciliation abundant and conspicuous at $70\times$ on veins, anterior margin, and surface of pterostigma of forewing. Clypeus with usual striations, these not forming a pair of spots. Females not known to be brachypterous, the forewings measuring about 2 mm in length. Colorless area of forewing forming a more or less continuous band from base of pterostigma to tip of vein Cu_1 .

FEMALE. Measurements, Table 1.

MORPHOLOGY. R_s fork in forewing about equal in length to stem. R_s index = 1.55. Subgenital plate (Fig. 42) with small, transverse, darkly pigmented central area; median apical



FIG. 57. Map showing distribution of *Kaestneriella mexicana*, n.sp., *K. occidentalis*, n.sp., and *K. setosa*, n.sp.

lobe of plate somewhat tapering toward tip, beset with only a few short setae distally. Ovipositor valvulae (Fig. 41): first valvula slender, slightly upcurved at tip, the subapical region beset on medio-ventral side with numerous minute setae. Second and third valvulae typical of the genus. Sensory cushion of paraproct bearing 16 and 18 trichobothria on two sides of single specimen counted.

COLOR (in alcohol). Body essentially as described for *K. obscura* ♀. Forewing (Fig. 8) uniformly pale brown except for colorless area extending from base of pterostigma posteriorly to vein Cu_1 , and postero-distally along that vein, with small interruptions to end of vein.

VARIATION. Some specimens are duskier than others, the differences seemingly due to a fading of the paler ones in alcohol a longer time. Color differences probably due to age are also noted within series preserved at the same time.

RANGE. Southern Mexico and Guatemala, north on the Pacific Coastal plain to Sinaloa.

TYPE LOCALITY. Ejido Libertad, 1 mile southwest of Frontera, Tabasco, Mexico, March 17 and 18, 1964, E. L. Mockford and A. Manzano, collectors, holotype ♀ and 4 ♀ paratypes. Types are in the collection of the senior author.

RECORDS (Fig. 57). El Salvador: Summit of Cerro Verde.

Guatemala: Dept. of Baja Verapaz: 1 mile north of Salama; 8 miles west of Salama.

Mexico: Chiapas: 8 miles south of Las Cruces Junction (Hwy. 195); 6 miles west of San Cristobal de las Casas (Hwy. 190); 8 miles north of Tuxtla



FIG. 58. Map showing distribution of *Kaestneriella minor*, n.sp., *K. obscura*, n.sp., and *K. pacifica*, n.sp.

Gutierrez (Hwy. 190). Oaxaca: 10 miles northwest of Tapanatepec (Hwy. 190). Sinaloa: 14 miles southeast of Villa Union (Hwy. 15).

HABITAT. This species has been taken primarily on shrubs and low trees in scrubby woodland and partially-cleared pasture areas. It was taken once on pine (*Pinus* sp.), once on tangerine (*Citrus reticulata*) and once on tamarind (*Tamarindus indica*).

DISCUSSION. A single male taken near Santiago Tuxtla, Veracruz, Mexico is of essentially the same size as females of this species, and its wing ciliation is similar. Its color is poorly developed due to tenerality, but that which can be made out of its color does not rule out the possibility of its being this species. Its measurements are included (Table 1), and figures of its genitalic structures are presented (Figs. 43, 44, and 45). Its R_5 index is 1.35.

Kaestneriella sp. (♀)³

Three females from southern Arizona appear to represent a distinct species. In general, they are similar to females of *K. obscura* and *K. mexicana*. The

³ After this paper had been accepted for publication, the senior author examined the type of *Peripsocus fumosus* Banks, described from southwestern Colorado. The type, a female, dried on a paper triangle, proved to be a *Kaestneriella*, and may be conspecific with this unidentified species. On the regression of posterior tibial length on forewing length, it falls in the space between the points formed by the unidentified species and those of *K. mexicana*.

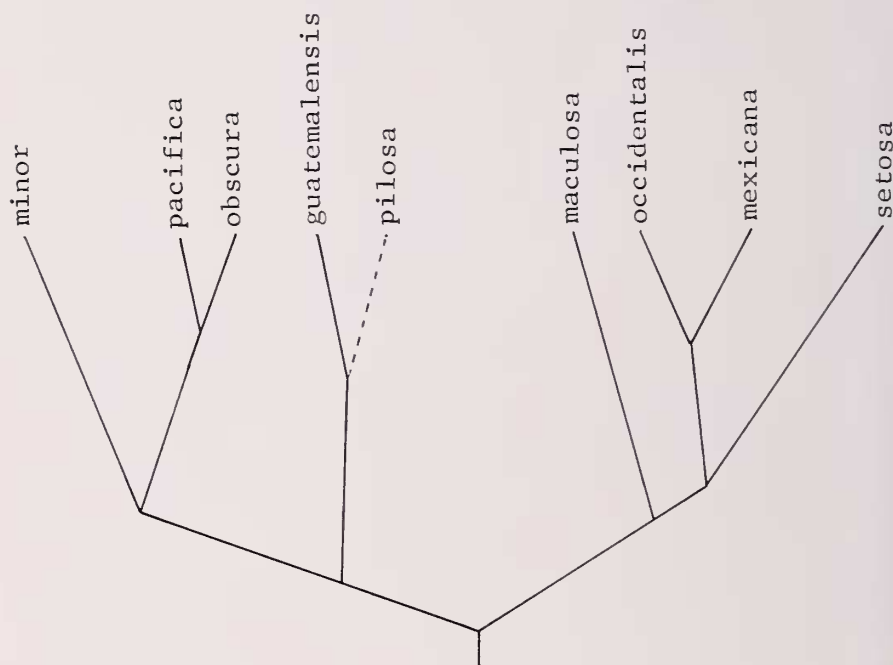


FIG. 59. Dendrogram showing the probable phylogenetic relationships of the species of *Kaestneriella*.

subgenital plate differs from those of either of these two species in that the lateral arms of its pigmented area are shorter and more rounded. On a scatter diagram of forewing lengths plotted against posterior tibial lengths (Fig. 56), these three specimens fall close together and well outside of the aggregations of points formed by *K. obscura* and *K. mexicana*. None of the other species with which they might be confused would fall near these. We decline to describe them as a new species until additional material is at hand.

RECORDS. United States: Arizona: Madera Canyon, Santa Rita Mountains (Pima County); Patagonia Mountains, 15 miles south of Patagonia (Santa Cruz County); Southwest Research Station, Portal (Cochise County).

PHYLOGENETIC RELATIONSHIPS IN *Kaestneriella*

We follow Eichler (1952) and Pearman (1960) in restricting the family Peripsocidae so as to include only the genera *Peripsocus* and *Kaestneriella*, thus treating the Ectopsocids as a distinct family. Unfortunately, the Peripsocidae is so poorly known at present that nothing can be stated about direction of evolution of any characters found within the group.

There can be no doubt that the species treated here as constituting the genus *Kaestneriella* form a monophyletic group within the Peripsocidae. A survey of the described and some undescribed forms of Peripsocidae suggests that those members of the family which do not fall within *Kaestneriella*, hence which are treated currently as *Peripsocus*, are much more diverse. Eventually, other genera will probably have to be erected within this group. A full understanding of phylogenetic relationships within this family will require much more collecting, especially in tropical upland areas.

Since the forms remaining in *Peripsocus* apparently do not constitute a natural group, it is impossible to compare *Kaestneriella* with *Peripsocus* in an attempt to determine which characters are primitive, and which specialized within these genera. We have also not been able to select a group of species within *Peripsocus* which seem to be most closely related to *Kaestneriella*.

Two ways remain open for approaching the problem of phylogeny within *Kaestneriella*. One consists in attempting to determine what is the most important morphological break within the genus and equating this with the fundamental phylogenetic dichotomy. The other consists in determination of concordances within the group for a set of all of the characters studied to date. Since the two approaches are entirely different, the two sets of data will not necessarily be perfectly correlated.

The most obvious morphological break lies in the structure of the radular sclerites, the main pair of sclerites being either three-pronged or simple. A perfect correlation exists between this break and a break in phallosome shape, so that those forms with three-pronged radular sclerites always have the phallosome tapering toward its base, while those forms with simple radular sclerites always have the sides of the phallosome straight or slightly bowed outward, but not tapering toward the base. In addition, the forms with the main pair of radular sclerites simple always have a small rounded sclerite lateral to each larger sclerite. These small, rounded sclerites are absent, as such, in the other forms. An examination of fifteen characters reveals no other morphological break of the magnitude of this one, so that we tentatively regard this break as indicating the fundamental dichotomy of our dendrogram (Fig. 59).

Concordance data based on fifteen characters (Table 2) show obvious high concordance between *K. mexicana* and *K. occidentalis*, also between *K. obscura* and *K. pacifica*, hence these species are joined in pairs on the dendrogram. In view of our postulated fundamental dichotomy, we must regard the relatively high concordance between *K. obscura* and *K. mexicana* as artificial. *K. setosa* is placed close to *K. mexicana* and *occidentalis* and *K. maculosa* is placed somewhat more basally on basis of our dichotomy hypothesis and the highest concordance figure for each species. On the other branch of the basal dichotomy *K. guatemalensis* occupies a position near the base, rather far

TABLE 2. Matrix of percentages of concordance for *Kaestneriella* species based on fifteen characters.*

	minor	pacifica	obscura	guatemalensis	maculosa	occidentalis	mexicana	setosa
minor	X	64.5	68.1	40.0	45.4	35.0	38.4	45.4
pacifica		X	73.3	52.1	32.2	53.3	44.5	32.2
obscura			X	51.1	24.0	66.6	69.0	47.4
guatemalensis				X	49.3	51.0	43.4	59.4
maculosa					X	44.0	48.0	60.0
occidentalis						X	75.5	67.3
mexicana							X	70.5
setosa								X

* Each number represents the number of characters shared between the pair of species indicated divided by 15 and the quotient multiplied by 100. The following characters were used:

1. Shape of phallosome: either tapering or parallel-sided.
2. R_5 index, the range (1.11 to 1.40) treated as six classes and scored from 1 to 6.
3. Forewing ciliation: present or absent.
4. Marking of vertex: dark spot bordering eye versus separated from eye.
5. Clypeal marking: two dark spots versus no dark spots.
6. Nature of radular sclerites: pair of hooks scored as 1; pair of hook-tipped sclerites with two shorter projections on each scored as 2; pair of three-pronged sclerites, the longest prong straight, scored as 3.
7. Clunial comb straight versus incurved in middle.
8. Second row of teeth in clunial comb; present or absent.
9. Dark central area of subgenital plate: single (Fig. 42) or double (Fig. 34).
10. Posterior lobe of subgenital plate: longer than wide (Fig. 32) or not longer than wide (Fig. 34).
11. Distal dark marks in forewing present (Fig. 7) or absent (Fig. 9).
12. Pale mark posterior to radio-medial junction in forewing in female: continuous to posterior wing margin (Fig. 2) or not (Fig. 9).
13. Microtrichs of first valvula: numerous (Fig. 49) or few (Fig. 47).
14. Male forewing length: three non-overlapping classes assigned scores of 1, 2, and 3.
15. Pair of rounded sclerites in radula present or absent.

When a pair of species was compared for a character assigned more than two states, they were scored as sharing the character totally if it was in the same state in both species, fractionally if one species had the character in an intermediate state (i.e., with a score of 2 where three states occurred), and as not sharing it if the character was in as different states as possible in the two species.

removed from the remaining species as suggested by its generally low concordance figures. *K. minor* shares a branch with the pair *K. obscura* and *K. pacifica* as suggested by its concordance figures.

The only striking incongruity in the above pattern of phylogeny lies in the decidedly similar head markings of *K. maculosa* and *K. minor*. In both species, the clypeus is marked by a conspicuous pair of spots. In *K. maculosa* the dark mark ordinarily bordering the compound eye is separated by a space from the eye, and in *K. minor* the dark mark which probably corresponds

to the one bordering the compound eye is further separated from the eye and larger. In view of the general low concordance between these two species, their similar head markings must have arisen independently.

Literature Cited

- EICHLER, R. 1952. Die Tierwelt der Gewächshäuser. Leipzig, iv + 93 pp.
PEARMAN, J. V. 1960. Some African Psocoptera Found on Rats. The Entomologist, **93**: 246-250.
ROESLER, R. 1943. Über Einige Copeognathengenera. Stett. Entomol. Zeit., **104**: 1-14.
-

BUTTERFLY SPECIMENS WANTED

W. V. Krivda (P.O. Box 864, The Pas, Manitoba, Canada) wishes to obtain for his research specimens of *Limenitis* or *Basilarchia* from the contact zone of *L. arthemis* and *L. a. astyanax*. He especially hopes for the "hybrids" between the two. The condition of the specimens is not important.

In exchange he can offer northern Canadian butterflies, or population samples of species in his locality.